

# Organizational dynamics of an information system: case study from the forestry sector

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**Abstract:** The Forest Department in the State of Uttar Pradesh, India developed Forest Management Information System (FMIS) for achieving organizational goals of improved financial and human resource management, improvement in the management of forests and wildlife, and for achieving responsive administration. This paper, based on field research, presents an assessment of the dynamics of FMIS in organizational context for a better understanding of such systems in forestry organizations. The paper also investigates the success of FMIS in assisting decision makers in achieving organizational goals. Based on the knowledge developed during the course of the study, key learning elements have been highlighted for the benefit of the stakeholders in information systems in forest sector.

**Keywords:** Business process reengineering; Culture change; Human resource; Information system; Socio-economic profile; Strategic management

## Introduction

Information, as a resource, is increasingly gaining importance in many organizations. Every task whether at operational (or tactical) or strategic level is somehow related to storage, processing or provision of information. Executives spend about 80 percent of their time on processing and communication of information (Davis and Ohlson 1985). Efficient management tools can support the use of resource 'information'. Information management is facilitated through current developments such as the increasing user friendliness of computer systems, increasing access to data through new storage media and electronic communication networks, and increasing systems compatibility and integration (Wiggins 1994, Bergeron *et al.* 1990, and Sethi *et al.* 1993). However, such technological improvements only provide the vehicle for driving on the so called 'information highway'. In addition, road networks and maps are necessary for orientation and special skills are required to navigate the vehicle. Moreover, target destinations need to be clearly defined so that correct direction can be chosen. A public sector forestry organization has specific requirements for a management information system (MIS--- A Management Information System is a computer-based system

that provides managers at all organizational levels with a minimum set of critical information for planning, operating, monitoring, evaluating and decision-making (Davis and Ohlson, 1985) ); such a social sector MIS should have high degree of flexibility in managing new needs and roles. They have to respond to an environment that changes in short cycles. An equally flexible infrastructure and information flow are essential to the success of managing change. All these factors right from the conceptualization to institutionalization make the development of MIS, a challenging task.

The aim of the present paper is to analyze the existing MIS in Uttar Pradesh Forest Department (UPFD) in the State of Uttar Pradesh (UP), India so as to have better understanding of dynamics of IS at organizational level. The outcome of this research is expected to result in better adoption of IS in similar forestry organizations.

## Methodology

The present study didn't start with any preconceived hypothesis and as the aim was to develop a new understanding on the subject, qualitative research approach was adopted.

### Qualitative approach

Case study methodology (Ackoff 1961; Allen 1978) was adopted as it is well-suited to IS research when the interest is shifted to organizational rather than technical issues (Davis 1992). Researcher works on FMIS in the organization of study i.e. UPFD. Approach of ethnography (Dennis *et al.* 2001) was also adopted for conducting the study.

### Sample design

Each UPFD office, from PCCF to DFO level, has been taken as the sampling unit. 10 pilot implementation sites (offices) (UPFP 1999e) for study on FMIS were selected as listed below:

1. CCF, Wildlife, Lucknow; 2. CCF, Central Zone, Lucknow;
3. CF, Lucknow; 4. CF, Working Plan (WP), Lucknow; 5. DFO,

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Lucknow; 6. Director, Lucknow Zoo, Lucknow; 7. Deputy Director, Dudhwa National Park, Lakhimpur-Kheri; 8. DFO, South Kheri Forest Division, Lakhimpur-Kheri; 9. Director/CF, Research, Kanpur; 10. Silviculturist/DFO, Southern Region, Kanpur.

From 7 territorial/wildlife offices, 10 persons from each office, and from rest of the offices, 5 persons from each office were selected either on preferential or random basis for data collection.

#### Data collection from primary sources

Observation techniques (Wilkinson *et al.* 1979; Garcia *et al.* 2003) and interview methods (Denzin *et al.* 1994; Hyman 1975; Kerlin 2000) were applied for data collection from primary sources.

#### Data collection from secondary sources

Data collection methodology as described in Orlikowski *et al.* (1991); and CESSDA, 2004 was used for collection of data from secondary sources. Following documents covering all aspects of FMIS were consulted for data collection:

1. Office files of FMIS (UPFP, 1997-2004)
2. Documents related to FMIS project viz. Terms of Reference (UPFP 1998h), Contract (UPFP 1998d), Inception report (UPFP 1998e), Needs Analysis (UPFP 1998f), Conceptual Design (UPFP 1998c), Detailed Design (UPFP 1999c), Human Resource Development (HRD) Plan (UPFP, 1999d), Software Specifications (UPFP 1999e), FMIS Implementation Plan (UPFP 1998g), and Implementation Review Reports (UPFP 2003c)
3. Ad-memoir of the World Bank Missions (UPFP 1998a; UPFP 1998b; UPFP 1999a; UPFP 1999b; UPFP 2000a; UPFP 2000b; UPFP 2001a; UPFP 2001b; UPFP 2002; UPFP 2003a; UPFP 2003b)

#### Data analysis

Secondary sources of data were looked into for understanding the context and functionalities of FMIS in UPFD. Data collection through observations was intended to be more than just looking and seeing. The aim was to record a true picture of working of the FMIS in UPFD. After observations, discussions were held with the participants and their viewpoints were noted. During interviews special emphasis was placed on knowing the organizational context of FMIS. Data from different sources was expected to reveal a range of views and biases. Triangulation (Ackoff 1962; and Gallivan 2004) i.e. cross-referencing was applied to reduce biases.

#### Result

Qualitative research methodology gave an understanding into the concept, functioning and issues involved with FMIS in UPFD; and the organizational context of UPFD in which FMIS functions. Knowledge developed at this stage was soft in nature. Quantitative research methods were adopted for testing its appropriateness and generalization.

#### Quantitative approach

##### Sample design

As on January 10, 2006 there were 123 such offices in the State. Based on understanding developed during qualitative study, UPFD offices exhibit five types of forestry functions (Territorial offices-A, National Parks/Sanctuaries-B, Zoos-C, Research/Training/Other Offices-D, Working Plan Offices-E), three

types of management functions (Strategic-S, Tactical-T, Operational-O), and three categories of socio-economic profiles (High-1, Medium-2, Low-3).

For each UPFD office, its characteristics based on forestry and management function, and socio-economic profile was identified. A three digit coding system (XYN) was applied for UPFD offices where X denotes forestry function (A, B, C, D, or E), Y signifies management function (O, T, or S), and N represents socio-economic profile (1, 2, or 3). Sample size of 10% was considered as adequate (Deming 1960; and John 1971). 10 offices of UPFD, where case study was conducted earlier, were excluded and from the remaining 113 offices, 15 were selected on random and preferential selection basis for data collection as detailed in Table 1.

**Table 1. Distribution of UPFD offices, grouping of UPFD offices based on their characteristics, selection of UPFD offices for data collection along with codes assigned to these offices**

Office code	No. of offices	Number of offices after grouping	Sample size	Selection criterion	Name of the office	Office code
AO1	8	8	1	R	DFO, Kanpur	AO1
AO2	12	12	1	R	DFO, Shahjahanpur	AO2
AO3	47	47	5	R	DFO, Fatehpur	AO3 <sub>a</sub>
					DFO, North Lakhimpurkheri	AO3 <sub>b</sub>
					DFO, Bahraich	AO3 <sub>c</sub>
					DFO, Basti	AO3 <sub>d</sub>
					DFO, Mahoba	AO3 <sub>e</sub>
AT1	9	9	1	R	CCF, Allahabad	AT1
AT2	4	5	1	R	CF, Jhansi	AT2
AT3	1					
AS1	2	2	1	P	PCCF, UP, Lucknow	AS1
BO1	3	10	1	R	DFO, Katarniaghat	BO3
BO3	4				Sanctuary, Baharaich	
BT1	1					
BT3	2					
BS1	0					
CO1	1	1	1	P	Director, Zoo, Kanpur	CO1
DO1	5	7	1	R	PCCF, Training & Research, Lucknow	DS1
DS1	2					
DT1	7	7	1	R	CF, World Food Programme, Lucknow	DT1
EO1	1	5	1	R	WPO, Agra	EO1
EO2	1					
EO3	2					
ET1	0					
ES1	1					
	113	113	15			

P: preferential selection; R: random number selection

Note: Approach for selection:

Categories having number of offices less than five were grouped together with the rider that at least one office should be selected from each forestry function category.

In the category AS1, there are only two offices viz. Office of the PCCF, UP & CCF, Social Forestry. Office of the PCCF, UP being unique was selected and the office of CCF, Social Forestry, Lucknow was rejected. In the category CO1, there is only one zoo i.e. Kanpur Zoo. Being unique, it was selected.

Following categories were grouped together as the number of offices in these categories was less than five:

AT2 + AT3; BO1 + BO3 + BT1 + BT3 + BS1; DO1 + DS1; EO1 + EO2 + EO3 + ET1 + ES1

Only exception is DO1 and DS1. DO1 has five offices and there are two offices in DS1 and as there are no other offices in D category thus DS1 was clubbed with DO1 category.

#### Data collection

These UPFD offices, through FMIS, generate two types of reports:

All offices generate certain number of reports based on information that is internal to their office only. Such reports have been named as office domain reports.

Tactical and strategic level offices generate administrative reports which include reports of their own office and from all the subordinate offices. Such reports have been termed as administrative domain reports.

Percentage of reports that a particular office is able to generate through a module of FMIS is the measure of success of that module in that particular office. Following terms were defined:

$N_O$  = Number of office domain reports that need to be generated through a particular module in an office

$N_A$  = Number of administrative domain reports that need to be generated through a module in an office

$n_O$  = Number of office domain reports that are presently being generated through the module in an office

$n_A$  = Total number of administrative domain reports that are presently being generated through the module in an office

$S_O$  = Office domain success of a particular module in an office,  $n_O * 100 / N_O$

$S_A$  = Administrative domain success of a particular module in an office,  $n_A * 100 / N_A$

**Statistical analysis:** Analysis of variance (ANOVA) for each source of variation was carried out and the variance table (Bailey 1994) was set up for assessing statistical similarities and dissimilarities between sources of variation.

### Result

Statistical analysis yielded following results:

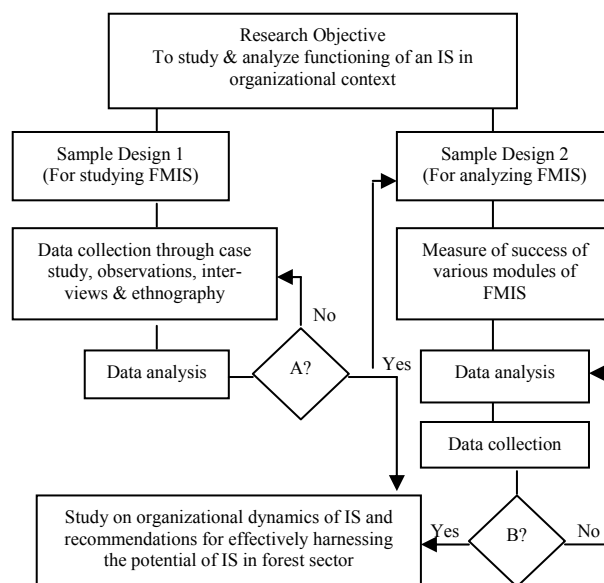
1. Variation in the functioning of FMIS at office and administrative domain level.
2. Variation in the functioning of various modules of FMIS.
3. Variation in the functioning of FMIS for different forestry functions.
4. Variation in the functioning of FMIS for different management functions.
5. Variation in the functioning of FMIS for different socio-economic profiles.
6. Extent to which FMIS has been successful in achieving the organizational goals of UPFD.

Flow diagram for the methodology has been shown in Fig. 1.

## Results

### Outputs

The outputs are the core element of the system since they have to meet users' requirements and thus determine success or failure of the system. Broadly speaking there were two categories of outputs viz. periodic outputs at defined intervals and outputs upon demand. Periodic outputs are the reports which are needed either on weekly, fortnightly or longer intervals. Numbers of reports, both in office and administrative domain, which need to be generated through various modules of FMIS have been listed in Table 2.



**Fig. 1 Flow diagram of the methodology**

A: Can concept, functioning, issues involved with FMIS and organizational context of UPFD be identified?

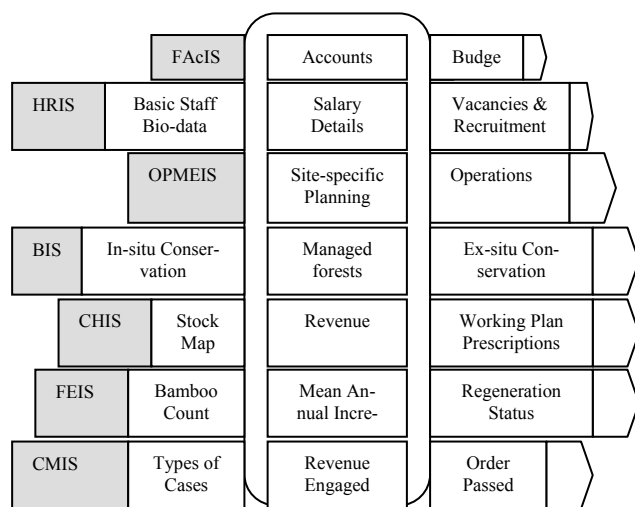
B: Can inferences be drawn?

**Table 2. Number of office and administrative domain reports which need to be generated through seven modules of FMIS for various offices of UPFD**

Office code	FAcIS		HRIS		OPMEIS		BIS		CHIS		FEIS		CMIS	
	$N_O$	$N_A$	$N_O$	$N_A$	$N_O$	$N_A$	$N_O$	$N_A$	$N_O$	$N_A$	$N_O$	$N_A$	$N_O$	$N_A$
AO1	53	-	54	-	29	-	44	-	12	-	9	-	17	-
AO2	53	-	54	-	29	-	44	-	12	-	9	-	17	-
AO3 <sub>a</sub>	53	-	54	-	26	-	44	-	12	-	9	-	17	-
AO3 <sub>b</sub>	53	-	54	-	29	-	44	-	12	-	9	-	17	-
AO3 <sub>c</sub>	53	-	54	-	29	-	44	-	12	-	9	-	17	-
AO3 <sub>d</sub>	53	-	54	-	29	-	44	-	12	-	9	-	17	-
AO3 <sub>e</sub>	53	-	54	-	29	-	44	-	12	-	9	-	17	-
AT1	53	53	54	54	3	29	5	44	-	12	-	9	5	17
AT2	53	53	54	54	3	29	5	44	-	12	-	9	5	17
AS1	53	53	54	54	3	29	5	96	-	12	-	9	5	17
BO3	53	-	54	-	29	-	47	-	12	-	9	-	17	-
CO1	53	-	54	-	17	-	24	-	12	-	9	-	12	-
DS1	53	53	54	54	-	29	-	-	3	12	-	9	5	17
DT1	53	5	54	-	3	-	-	-	-	-	-	-	4	-
EO1	53	-	54	-	5	-	-	9	12	-	9	-	4	-

FMIS consists of seven modules viz; FAcIS: Finance and Accounting Information System; HRIS: Human Resource Information System; OPMEIS: Operations, Planning, Monitoring, and Evaluation Information System; BIS: Biodiversity Information System; CHIS: Compartment History Information System; FEIS: Forest Enumeration Information System; CMIS: Case Management Information System; “-” indicates that there are none reports to be generated

The logic of how output needs are generated has been illustrated with the help of a slide rule model. The user can query the system by combining information categories at different levels as shown in Fig. 2.



**Fig. 2 Output slide rule mechanism for getting information on demand**

#### System Links and Integration

The underlying concept of the FMIS is a modular system that highly integrates with existing paper based data sources. Links have been made to existing paper-based information that contains data needed as inputs to the FMIS and these have been termed as 'primary links'. For ensuring ease and uniformity across the UPFD input contents, timeliness, media, format, and volume have been standardized.

As the system will develop dynamically, it may grow to provide more features than currently being anticipated. Such links are called 'secondary links' since they will be considered only in future phases of the FMIS development. Secondary links can include systems like geographic information system (GIS), decision support system (DSS), expert support systems (ESS), document management system (DMS), library information system

(LIS), and publicity information system (PIS). The modular FMIS concept will allow secondary links to be integrated upon demand.

#### Software and Hardware

Oracle 8i was selected as an appropriate database for the back end and visual basic was selected as front end tool. Intel Pentium IV entry level machines were considered to be capable enough for running the software and meeting the response time. Daily, automated backup is produced on magnetic tapes and kept for one week.

#### Human resource development

The system can function only if its users and administrators are well instructed in its operation and are comfortable in its use. Thus, both user and system administrator training was essential to the success of the FMIS. Training was incorporated in the step-wise implementation process through a combination of introductory courses, on-the-job training and supporting documentation, tutorials and presentations.

#### Resources and efforts provided for FMIS

The UPFD has spent Rs. 120 million (US\$ 2.70 million) on the procurement of 350 computers, 2 database servers, 2 mail servers, 2 VSATs, and software; and development of software; training of approximately 500 officers and 1800 staff on basic computer literacy and FMIS modules; etc. Total time spent was 36 months. The domain experts were drawn from different streams such as IT, systems analysis, HRD, training, biodiversity, forestry, finance, etc. A core group of 24 people was formed to work as resources persons within the UPFD and to provide support to the users of FMIS.

#### Performance of FMIS

Types of office and administrative domain reports that are presently being generated from all the seven modules for various offices of UPFD are shown in Table 3.

**Table 3. Number of office and administrative domain reports that are presently being generated through seven modules of FMIS for various offices of UPFD**

Office code	FAcIS		HRIS		OPMEIS		BIS		CHIS		FEIS		CMIS	
	n <sub>O</sub>	n <sub>A</sub>	n <sub>O</sub>	n <sub>A</sub>	n <sub>O</sub>	n <sub>A</sub>	n <sub>O</sub>	n <sub>A</sub>	n <sub>O</sub>	n <sub>A</sub>	n <sub>O</sub>	n <sub>A</sub>	n <sub>O</sub>	n <sub>A</sub>
AO1	14	-	11	-	11	-	8	-	2	-	1	-	1	-
AO2	11	-	5	-	7	-	7	-	1	-	1	-	2	-
AO3 <sub>a</sub>	6	-	2	-	5	-	1	-	1	-	1	-	1	-
AO3 <sub>b</sub>	4	-	3	-	5	-	2	-	2	-	2	-	1	-
AO3 <sub>c</sub>	5	-	3	-	6	-	1	-	3	-	1	-	1	-
AO3 <sub>d</sub>	3	-	2	-	4	-	2	-	1	-	1	-	1	-
AO3 <sub>e</sub>	7	-	3	-	2	-	0	-	1	-	1	-	1	-
AT1	11	3	7	2	1	1	1	1	-	1	-	1	1	1
AT2	12	12	6	6	1	8	1	0	-	1	-	1	1	1
AS1	16	3	10	1	2	1	1	0	-	0	-	0	2	0
BO3	5	-	1	-	3	-	9	-	1	-	1	-	1	-
CO1	17	-	9	-	6	-	14	-	1	-	1	-	2	-
DS1	15	8	8	5	-	5	-	-	-	1	-	1	1	1
DT1	13	1	9	-	2	-	-	-	-	-	-	-	1	-
EO1	15	-	10	-	3	-	-	0	10	-	8	-	1	-

Office and Administrative domain success for all the seven modules of FMIS is shown in Table 4.

Analysis of success of FMIS with respect to organizational characteristics of UPFD

#### *Performance of various modules of FMIS*

Average success of all the seven modules of FMIS at office domain level has been shown in Table 5(a).

The module OPMEIS has been found to be most successful (31.83%). ANOVA (at 5%) gave  $F=2.418$  while  $F_{crit}=2.209$ . With 96.7% confidence level we are able to say that statistically there exist dissimilarities among the office domain success of

various modules of FMIS. Result of further investigation has been presented in Table 6.

#### *Performance of FMIS vis-à-vis forestry functions of UPFD offices*

Average success of FMIS at office domain level for UPFD offices performing various forestry functions has been shown in Table 5(b). Working Plan Office has adopted FMIS most successfully (50.67%). ANOVA (at 5%) gave  $F=11.153$  while  $F_{crit}=2.478$ . With almost 100% confidence level we are able to say that statistically there exist dissimilarities among the office domain success of FMIS for UPFD offices performing different forestry functions. Result of further analysis has been presented in Table 7.

**Table 4: Office and administrative domain success of seven modules of FMIS for various offices of UPFD**

Office code	FAcIS		HRIS		OPMEIS		BIS		CHIS		FEIS		CMIS	
	S <sub>O</sub>	S <sub>A</sub>	S <sub>O</sub>	S <sub>A</sub>	S <sub>O</sub>	S <sub>A</sub>	S <sub>O</sub>	S <sub>A</sub>	S <sub>O</sub>	S <sub>A</sub>	S <sub>O</sub>	S <sub>A</sub>	S <sub>O</sub>	S <sub>A</sub>
AO1	26.42	-	20.37	-	37.93	-	18.18	-	16.67	-	11.11	-	5.88	-
AO2	20.75	-	9.26	-	24.14	-	15.91	-	8.33	-	11.11	-	11.76	-
AO3 <sub>a</sub>	11.32	-	3.70	-	19.23	-	2.27	-	8.33	-	11.11	-	5.88	-
AO3 <sub>b</sub>	7.55	-	5.56	-	17.24	-	4.55	-	16.67	-	22.22	-	5.88	-
AO3 <sub>c</sub>	9.43	-	5.56	-	20.69	-	2.27	-	25.00	-	11.11	-	5.88	-
AO3 <sub>d</sub>	5.66	-	3.70	-	13.79	-	4.55	-	8.33	-	11.11	-	5.88	-
AO3 <sub>e</sub>	13.21	-	5.56	-	6.90	-	0.00	-	8.33	-	11.11	-	5.88	-
AT1	20.75	5.66	12.96	3.70	33.33	3.45	20.00	2.27	-	8.33	-	11.11	20.00	5.88
AT2	22.64	22.64	11.11	11.11	33.33	27.59	20.00	0.00	-	8.33	-	11.11	20.00	5.88
AS1	30.19	5.66	18.52	1.85	66.67	3.45	20.00	0.00	-	0.00	-	0.00	40.00	0.00
BO3	9.43	-	1.85	-	10.34	-	19.15	-	8.33	-	11.11	-	5.88	-
CO1	32.08	-	16.67	-	35.29	-	58.33	-	8.33	-	11.11	-	16.67	-
DS1	28.30	15.09	14.81	9.26	-	17.24	-	-	-	8.33	-	11.11	20.00	5.88
DT1	24.53	20.00	16.67	-	66.67	-	-	-	-	-	-	-	25.00	-
EO1	28.30	-	18.52	-	60.00	-	-	0.00	83.33	-	88.89	-	25.00	-
Mean	19.37	13.81	10.99	6.48	31.83	12.93	15.43	0.57	19.17	6.25	20.00	8.33	14.64	4.41
Range (min)	5.66	5.66	1.85	1.85	6.90	3.45	0.00	0.00	8.33	0.00	11.11	0.00	5.88	0.00
(max)	32.08	22.64	20.37	11.11	66.67	27.59	58.33	2.27	83.33	8.33	88.89	11.11	40.00	5.88
SD	9.09	7.92	6.36	4.41	20.07	11.74	15.80	1.14	23.26	4.17	24.46	5.56	10.33	2.94
SE ±	2.43	3.96	1.70	2.55	5.57	6.78	4.76	0.66	7.75	2.41	8.15	3.21	2.76	1.70
σ (±)	5.21	10.99	3.64	8.10	12.03	21.56	10.49	2.09	17.54	7.66	18.44	10.21	5.92	5.40

Office and Administrative domain success is in %; SD: standard deviation; SE: standard error; “σ” confidence limit at 5%

**Table 5. Average office domain success of various modules of FMIS, and average office domain success of FMIS for various forestry functions, management functions, and socio-economic profiles of UPFD offices**

(a) Modules of FMIS						
FAcIS	HRIS	OPMEIS	BIS	CHIS	FEIS	CMIS
19.37±5.21	10.99±3.64	31.83±12.03	15.43±10.49	19.17±17.54	20.00±18.44	14.64±5.92
(b) Forestry functions						
Territorial	National parks and sanctuaries	Zoos	Research, Training, and Other Offices		Working Plan Offices	
14.89±2.73	9.44±5.31	25.50±17.66	28.00±17.70		50.67±35.65	
(c) Management functions						
Strategic		Tactical			Operational	
29.81±15.15		24.79±8.15			16.12±3.95	
(d) Socio-economic profiles						
High		Medium			Low	
29.66±6.66		17.36±4.95			9.32±1.79	

**Table 6. ANOVA for office domain success of various modules of FMIS**

FMIS module	Dissimilar to	P-value	Similar to	P-value
FAcIS	HRIS	0.007	BIS	0.424
			CHIS	0.975
			FEIS	0.928
			CMIS	0.194
HRIS	OPMEIS	0.001	BIS	0.328
			CHIS	0.205
			FEIS	0.183
			CMIS	0.253
OPMEIS	BIS	0.031	CHIS	0.168
			FEIS	0.207
BIS	CMIS	0.007	CHIS	0.660
			FEIS	0.603
			CMIS	0.876
			FEIS	0.939
CHIS			CMIS	0.512
			FEIS	0.455

**Table 7. ANOVA for office domain success of FMIS in UPFD offices performing different forestry functions**

Forestry function	Dissimilar to	P-value	Similar to	P-value
Territorial	Zoo	0.028	National park and sanctuary	0.208
	Research, training and others	0.007		
	Working plan	0.000		
National park and sanctuary	Zoo	0.040	Research, training and others	0.796
	Research, training and others	0.021		
	Working plan	0.005		
Zoo			Working plan	0.094
			Working plan	0.127

*Performance of FMIS vis-à-vis management function of UPFD offices*

Average office domain success for UPFD offices with three categories of management functions has been shown in Table 5(c). Offices at strategic management level have adopted FMIS most successfully (29.81%). ANOVA (at 5%) gave  $F=3.732$  while  $F_{crit}=3.100$ . With 97.2% confidence level we are able to say that statistically there exist dissimilarities among the office domain success of FMIS for these three categories of management functions. Result of further analysis has been given in Table 8.

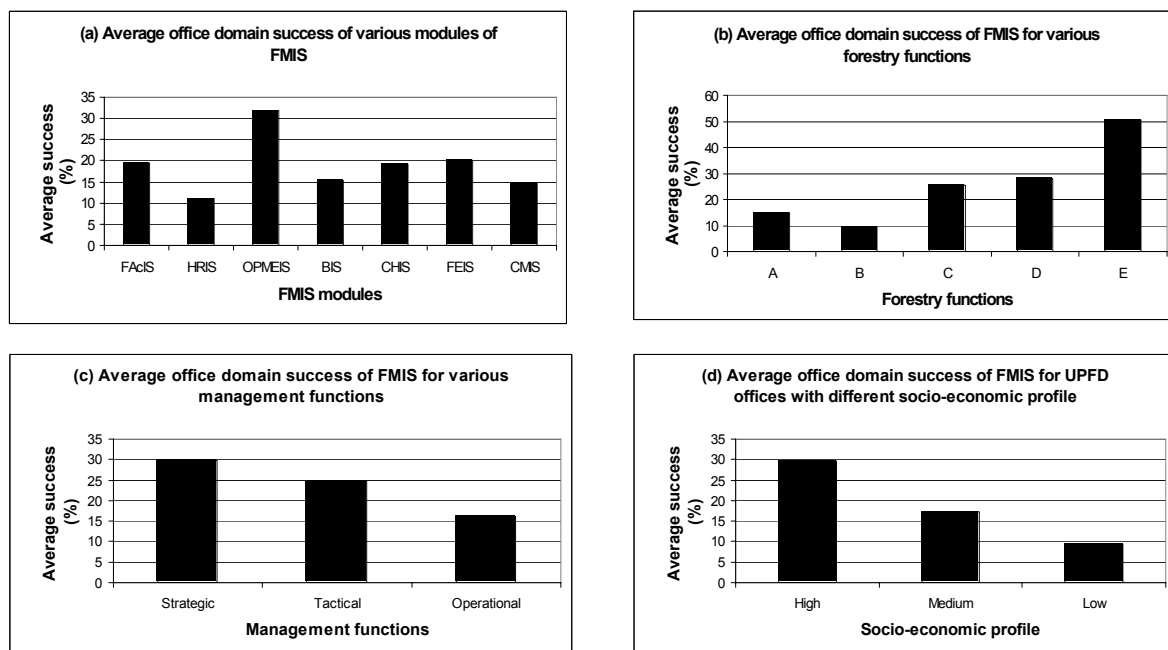
**Table 8. ANOVA for office domain success of FMIS in UPFD offices performing different management functions**

Management function	Dissimilar to	P-value	Similar to	P-value
Strategic	Operational	0.031	Tactical	0.454
Tactical	Operational	0.071		

*Performance of FMIS vis-à-vis socio-economic profile of UPFD offices*

Average office domain success for UPFD offices falling under different socio-economic profile has been tabulated in Table 5(d). Offices with high rating on socio-economic profile have adopted FMIS most successfully (29.66%). ANOVA (at 5%) gave  $F=21.125$  while  $F_{crit}=3.100$ . With almost 100% confidence level we are able to say that statistically there exist dissimilarities among the office domain success of FMIS for offices with different socio-economic profiles. Further analysis revealed that performance of FMIS in different socio-economic profiles is dissimilar to one-another.

Average success of various modules of FMIS, and average success of FMIS for various forestry functions, management functions, and socio-economic profiles of UPFD offices has been shown in Fig. 3.

**Fig. 3. Performance of FMIS at office domain level**

Analysis of success of FMIS at office and administrative domain level

Average success of FMIS, as a whole, at office and administrative domain level has been shown in Table 9(a).

**Table 9. Average office and administrative domain success of FMIS in UPFD, and average success of FMIS in meeting the information needs related to organizational goals of UPFD**

(a) Domain levels			
Office domain		Administrative domain	
18.65±3.45		7.76±2.79	
(b) Organizational goals			
Financial manage- ment	Human re- source man- agement	Management of natural resources viz. forests and wildlife	Responsive administra- tion
22.55±5.07	10.04±3.06	14.49±5.56	12.49±5.02

ANOVA (at 5%) gave  $F=11.578$  while  $F_{crit}=3.921$ . With 99.9% confidence level we are able to say that statistically there exist dissimilarities between the office and administrative domain success of FMIS.

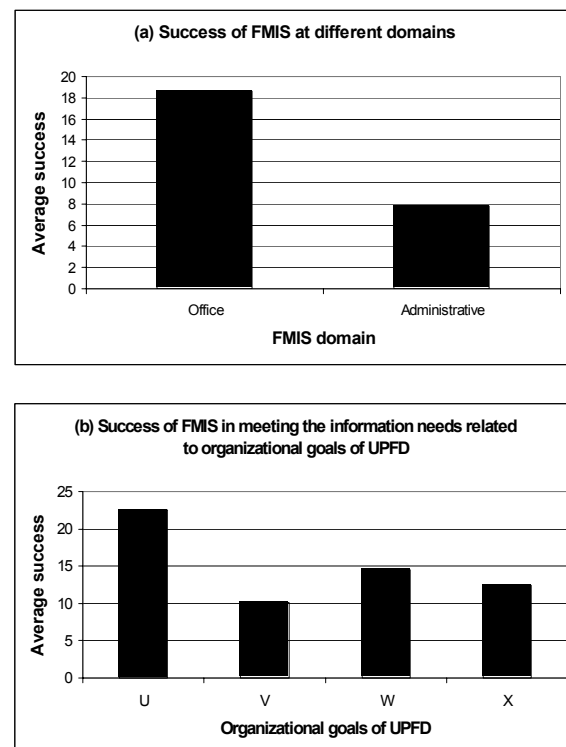
Analysis of success of FMIS with respect to organizational goals of UPFD

From Table 9(b) it is evident that average success of FMIS for making the information available for achieving good financial management is highest (22.55%). ANOVA (at 5%) gave  $F=3.841$  while  $F_{crit}=2.683$ . With 98.8% confidence level we are able to say that statistically there exist dissimilarities in average success of FMIS for meeting information needs related to organizational goals of UPFD. Result of further analysis has been shown in Table 10.

**Table 10. ANOVA for office domain success of FMIS for providing information to UPFD for meeting organizational goals**

Organizational goals of UPFD	Dissimilar to	P-value	Similar to	P-value
Financial management	Human resource management	0.002		
	Management of natural resources viz. forests and wildlife	0.039		
	Responsive administration	0.014		
Human resource management			Management of natural resources viz. forests and wildlife	0.314
			Responsive administration	0.375
Management of natural resources viz. forests and wildlife			Responsive administration	0.661

Average success of FMIS at office and administrative domain level, and average success of FMIS in meeting the information needs related to organizational goals of UPFD has been shown in Fig. 4.



**Legend:**

U--Financial management in UPFD; V--Human resource management in UPFD; W--Management of natural resources viz. forests and wildlife; X--Responsive administration in UPFD

**Fig 4. Performance of FMIS across the UPFD**

## Discussion

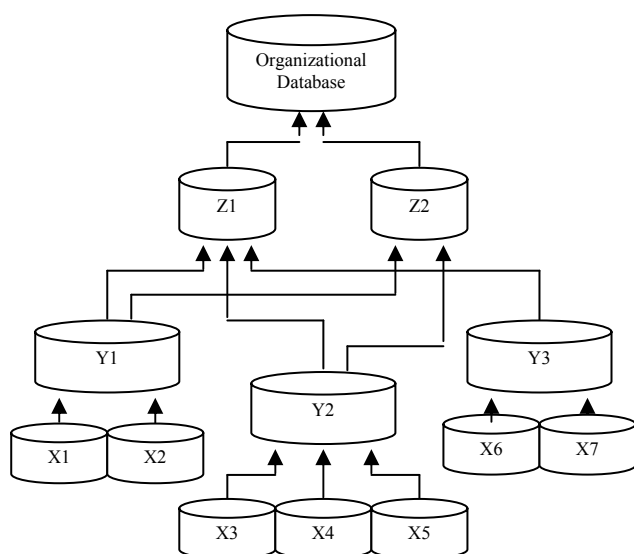
Organizational structure and information system

Public sector organizations by and large follow a command and hierarchy based organizational structure where data, information and reports flow from subordinate level to supervisor level. Direct flow of data or information or reports from subordinate level to higher level bypassing the immediate supervisory level is by and large not permitted. Adopting and implementing an IS with the same organizational structure has proved to be detrimental for its success. The structure which is presently being followed for the flow of information through IS has been shown in Fig. 4.

The flow of information is unidirectional. As evident from Figure 4, a weak linkage affects the entire chain and the overall performance gets controlled by the performance of the weakest link in the entire labyrinth of flow of information.

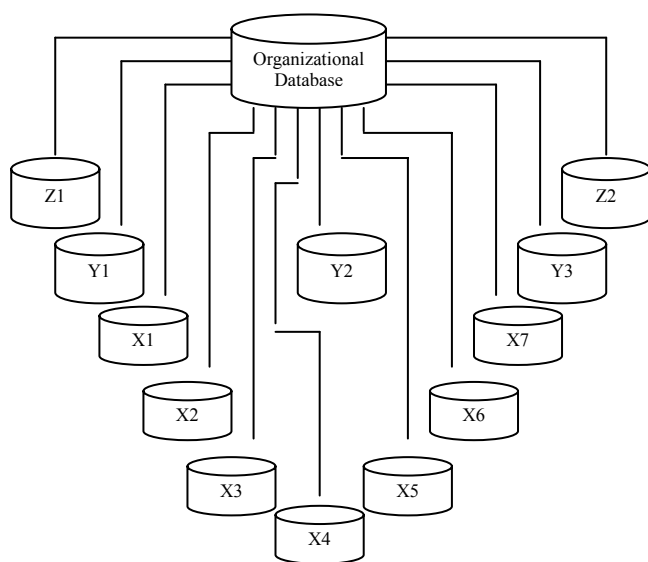
A flat structure of the organization where all the units are connected to a centralized database is expected to be more conducive for driving the benefits of IS. Such a structure has been proposed in Fig. 5.

Apart from facilitating both way flow of information this model ensures automatic readiness of database and is not adversely affected by artificial hierarchies in the organization.



**Note:** X: Lowest management level; Y: Middle management level; Z: Top management level

**Fig. 4. Hierarchical functioning of IS in a hierarchy based organization**



**Fig. 5. Functioning of IS based on centralized processing concept where hierarchical character of the organization can be maintained, if desired**

#### Functionalities of information systems

Adoption of FAcIS has the least variation among offices as compared to other modules. A further investigation revealed that finance and accounts people are well versed in computational

skills and are more comfortable with computers. Then there is statutory requirement of compiling the monthly accounts and sending the same to prescribed authorities in stipulated time limit and finance and accounts people are used to meeting these deadlines since their coming to UPFD. Adoption of this module is likely to increase further with the passage of time.

Offices with less number of employees have achieved better success in adopting HRIS due to lesser amount of historic records to be up-loaded in the FMIS.

OPMEIS has appeared to be most successful and the reason is not difficult to find out. It primarily consists of site-specific plans which are stand alone projects and don't have historical data which need to be entered for making best use of the module. This module in future could be used by UPFD for assessing the impact of various practices on forest health and knowledge management.

Performance of BIS clearly exhibit three characteristics viz. it is highest for zoo, falls somewhat in the middle for units where either the data entry is very less or which are more sensitive to wildlife management either due to being wildlife units or due to persistent problem of man-animal conflict, and the performance is least for the units where wildlife management is not a thrust area.

CHIS and FEIS have a success of around 20%. Working plan office has achieved exceptionally high success on these two modules. The average achievement of the remaining offices is around 12%. UPFD is more than a century and quarter old and there are on an average 200 compartments in a division. Working plan officer is entrusted with the job of preparing the working plan of a division(s) within a period of two years.

One important component of CMIS is keeping record of forest offence data. Forest offences in a typical field unit are in the range of 1500 to 2000 and shooting up to even 5000 in many forest rich and crime prone divisions. In higher management units, data related to forest offence, which is local to their office, is comparatively very less. Clearly the success of CMIS is inversely proportional to the number of forest offences pending for disposal.

#### Functional responsibilities of organizational units and information systems

Organizational units with specialized job responsibilities have adopted IS with more success as compared to units with multi-dimensional functions. Field units are slow in adopting IS as compared to functional units and reasons are not difficult to find out. Field units have to depend on many sources for getting the data while functional units depend on much lesser sources. Among the field units, territorial divisions have adopted IS with greater success as compared to wildlife units.

#### Management responsibilities of organizational units and information systems

When we look at the office domain success of IS for various management units, the grading is strategic, tactical and operational, in descending order. But when we look at the administrative domain success of IS, the order is reverse. What we need to appreciate is that senior managers need to be more concerned with the improvement of overall functioning of all the units under their control rather than the mere efficient functioning of their own offices.



### Socio-economic profile of the units and information systems

Public sector organizations with units spread over a vast geographical region witness that the units fall in regions with varied socio-economic profile. Regions with high rating have better availability of electricity, trained manpower, communication, maintenance facilities, and consumables. Success of IS is directly in order of the socio-economic profile of the region in which such units fall. The cherished goal that information and communication technology (ICT) will be helpful in bridging the gap between haves and have-nots is not only in doubts but ICT may even contribute to increasing the divide with increase in the availability of information resources with the existing haves. To handle this challenge the approach could be to provide generator sets to units where supply of electricity is poor, providing incentives to trained manpower to work in these areas, adopting centralized maintenance and supply of consumable contracts for ready availability, and transmitting the data either through satellite or sneakers net (data is carried on a disc through courier).

### Organizational goals and information systems

Flow of information for financial management is most successful as compared to flow of information for achieving other goals. Information flow for attaining other goals is not so encouraging and more or less it hovers around 12%. Further investigation revealed that, by and large, information related to financial component such as realization of revenue from the sale of saplings, and felling of trees gets captured and is reflected in the performance of natural resource management. Similarly realization of compensation and fines for forest offences and recovery of dues from employees are reflected in responsive administration and human resource management.

### Key learning elements

Information needs of any organization change over a period of time and all IS, whether manual or computer based, become redundant on time scale. Organizations need to make necessary adjustments in their IS for minimizing redundancy. Public sector organizations need to learn two things:

(1) Compute based IS are not capable of handling those information needs which were not anticipated during design phase without providing similar inputs at a subsequent stage when new information needs have arisen.

(2) Change in the information needs due to change in the vision and mission of the organization is a welcome move but changing information needs randomly and coming back to original ones in an erratic cyclic manner is suicidal both to the organizations and IS. Organizations need to follow certain discipline before they can hope to harness the potential of IS for the betterment of their stakeholders.

Finance and accounting package should be the first for implementation and if the implementation is carried out at the beginning of the fiscal year, very less historical data need to be entered into the database and the system can be easily made ready to use. Maximum stress should be laid for ensuring that the monthly accounts for first three months should be generated through the IS and accounts for the rest of the months will definitely be generated through the system as now the relevant historical data is in the system and it will not be possible to generate

the accounts through manual systems without putting much more efforts than needed by the IS.

Finance and accounts, and statistical personnel, by and large, are more comfortable in working with computers and thus their skill set need to be used for IS adoption.

Applications where paper based historical data is voluminous, domain knowledge is specialized and data generation rate through paper based systems is more than converting the same to electronic form needs special attention.

Applications of IS remains poor in those areas where even earlier the organization was not placing value. Top management needs to prioritize the mandate and communicate it to all concerned in the organization.

Strategic planning and management is based on data generated at the field level. If the organization's vision is not discussed with the field functionaries they may not be able to understand the significance of such data. Sharing of vision and mission in the organization is necessary for driving the maximum benefit of IS.

### Conclusion

Based on field research, and knowledge and participation of users of an IS in forest sector the present paper investigates the dynamics of an IS in organizational perspective. In developing economics public sector organizations are expected to play an important role in developmental activities and IS are expected to assist the managers in achieving this objective. A better understanding of organizational context coupled with resource sharing at the field unit levels, taking special care of not so developed areas, and business process reengineering is expected to lead to a better adoption of IS in these organizations and eventually leading to achieving the organizational objectives.

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